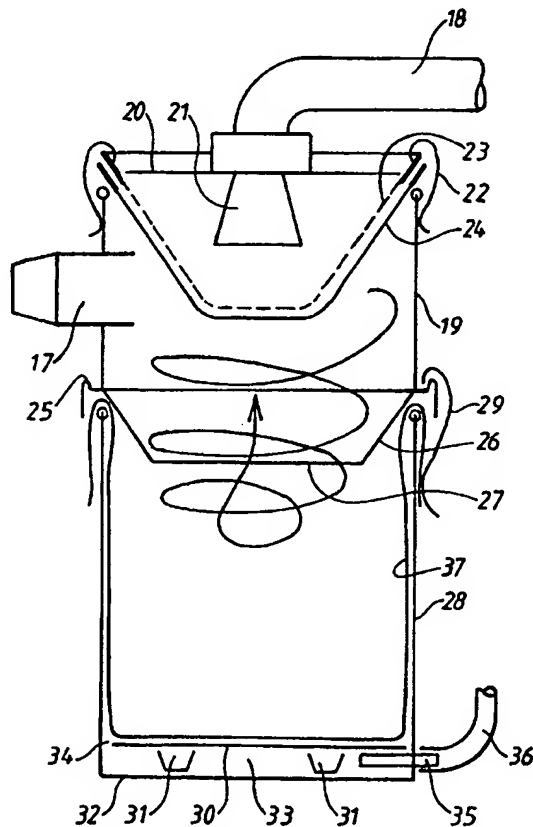


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>A47L 9/16</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/35602</b> <b>(43) International Publication Date:</b> 20 August 1998 (20.08.98)
<b>(21) International Application Number:</b> PCT/SE98/00241 <b>(22) International Filing Date:</b> 12 February 1998 (12.02.98)  <b>(30) Priority Data:</b> 9700500-3      13 February 1997 (13.02.97)      SE  <b>(71) Applicants (for all designated States except US):</b> AK-TIEBOLAGET ELECTROLUX (publ) [SE/SE]; S-105 45 Stockholm (SE). FRESHMAN AKTIEBOLAG [SE/SE]; Ritarislingan 16 B, S-183 66 Täby (SE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> KRANTZ, Evert [SE/SE]; Malmvågen 16 C, 7 tr., S-191 60 Sollentuna (SE).  <b>(74) Agents:</b> ERIXON, Bo et al.; AB Electrolux, Group Patents & Trademarks, S-105 45 Stockholm (SE).		<b>(81) Designated States:</b> CN, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> DEVICE FOR A CYCLONE VACUUM CLEANER  <b>(57) Abstract</b> <p>A device for a vacuum cleaner which is provided with a cyclone separator connected to a vacuum source. The device includes a cylindrical cyclone housing (19) with an inlet (17) through which dust laden air is tangentially drawn into the cyclone housing. A liner (26) is arranged below the cyclone housing and is generally shaped as a hollow up-side-down truncated cone. The liner has a lower opening (27) facing toward a collecting container (28). The collecting container is located below the opening. An outlet (21) is located centrally in the cyclone housing. The cyclone separator encloses a disposable filter (24) disposed between the inlet (17) and the outlet (21).</p>		



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## DEVICE FOR A CYCLONE VACUUM CLEANER

The present invention relates to vacuum cleaners which incorporate a cyclone separator connected to a vacuum source and comprising a mainly cylindrical cyclone housing with an inlet through which dust laden air is tangentially drawn into the cyclone housing and a liner arranged below the cyclone housing and shaped as a hollow up-side-down truncated cone with a lower opening facing toward a collecting container, and wherein the cyclone separator encloses a disposable filter disposed between the inlet and the outlet of the cyclone separator.

Vacuum cleaners of the above mentioned type are previously known, see EP 33250. This type of vacuum cleaner is designed such that particles separated by the cyclone fall down through the narrow opening of the truncated cone and are collected on the bottom of a container arranged below the cyclone. To empty the container, the cyclone separator has to be removed and the container has to be turned up-side down. However, particles and liquid have a tendency to stick to the walls which means that the container also has to be cleaned manually which is unpleasant and troublesome work. Moreover, the filter has to be removed separately which means further unpleasant work.

It is also previously known, see US 4523936, to use other types of dust separators which are provided with a system for collecting the dust in a bag which is inserted in a container and which can be easily removed and thrown away. The bag is kept in position in the container by connecting a space between the bag and container with a source of vacuum.

Accordingly, there exists a need in the art for a vacuum cleaner having a cyclone separator including a dust filter and a container and wherein the dust filter is easily removed when the container is to be emptied.

The present invention is directed toward an emptying system for vacuum cleaner incorporating a cyclone separator which in a simple and hygienic manner makes it possible to dispose of a filter at the same time that a container is emptied.

5 In accordance with the present invention, a device for a vacuum cleaner includes a cyclone separator having a cyclone housing, a liner, a collecting container, an inlet, an outlet, and a disposable filter. The inlet issues generally tangentially into the cyclone housing relatively above the liner. The liner  
10 is shaped as an upside-down truncated cone, and has a lower opening facing toward the collecting container. The outlet is centrally located in the upper end of the cyclone housing.

In further accordance with the present invention, the container is adapted to receive an air-impermeable bag. Means  
15 are provided for securing the bag by evacuating air from a space between the bag and the container walls. The lower opening of the liner is sized to permit the filter to fall downwardly through the liner opening and into the bag or container.

These and further features of the present invention will be  
20 apparent with reference to the following description and drawings, wherein:

FIG. 1 is a schematic vertical view showing a vacuum cleaner having a cyclone separator according to the present invention; and,

25 FIG. 2 is a schematic vertical section of the cyclone separator according to the present invention.

With reference to FIG. 1, a vacuum cleaner having a vacuum cleaner housing 10 enclosing a motor-fan unit 11 which serves as a vacuum source is illustrated. An inlet side of the fan is  
30 connected to a cyclone separator 12 arranged at a relatively forward portion of the vacuum cleaner. The cyclone separator 12, via a hose 13, a tube handle 14 and a tube shaft 15 communicates with a nozzle 16. As will be described hereinafter, the cyclone separator 12 serves as a filtering assembly which is operable to  
35 remove dirt, dust, and other particles from a dirty air stream supplied via the hose 13 and exhaust cleaned air via the fan.

As shown in FIG. 2, the cyclone separator 12 has an inlet part 17 shaped as a sleeve to which the hose 13 can be connected, an outlet part 18 which is connected to the inlet side of the fan unit 11, and a cyclone part disposed between the inlet part 17 and the outlet part 18.

The cyclone part includes a cylindrical cyclone housing 19 in which the inlet part 17 ends such that the incoming air is directed generally tangentially. An upper end of the cyclone housing 19 is covered by a cover 20 having a centrally-arranged, downwardly-extending sleeve 21 which communicates with the outlet part 18. The cover 20 is removably arranged on the cyclone housing and is retained thereon by means of clamps 22.

A cup-shaped filter holder 23 is disposed within the cyclone housing 19. An upper, outer periphery of the filter holder 23, which preferably has a perforated, mesh-like, or grating structure, is clamped between the cover 20 and the upper edge of the cyclone housing 19, as illustrated. The filter holder 23 serves as a support for a disposable filter 24 which is arranged relatively beneath the holder. The filter holder 23 prevents the filter 24 from being drawn into the sleeve 21 and outlet part 18.

The filter 24 is preferably made of a comparatively thin, air-permeable paper. The filter 24 is cup-shaped, and an outer periphery of the filter 24 is clamped between corresponding parts of the filter holder 23 and a portion of the cyclone housing 19 preferably without being folded downwardly. As will be apparent from the following description, the engagement between the outer periphery of the filter 24 and the upper edge of the filter housing 19 is preferably not sufficient to support the filter 24 when the cover 20 and filter holder 23 are removed from the cyclone housing 19. In order to increase the filter surface area, the filter holder 23 can include a plurality of downwardly extending ribs in engagement with the filter 24 and between which the filter will crumple during operation.

A lower end of the cyclone housing 19 has a collar-shaped part 25 and receives a liner 26. The liner 26 is shaped as a hollow, up-side-down truncated cone, and has a lower opening 27 facing toward a collecting container 28 for particles separated

by the cyclone. The opening 27 is sized such that the filter 24 can easily pass through the opening 27. The area of the opening is greater than 10%, and preferably greater than 30%, of the cross-sectioned area of the container. The collar-shaped part 25 of the cyclone housing 19 rests on the upper edge of the collecting container 28 and is retained thereon by means of several clamps 29, as illustrated.

The container 28 receives a circular plate 30 which, by means of widely spaced-apart distance means 31, is disposed above a bottom wall 32 of the container, thereby establishing a chamber 33 between the plate 30 and the container bottom wall 32. The plate 30, which may be perforated, has a somewhat smaller diameter than the inner diameter of the container 28, so as to create a peripheral slot or gap 34 between the container side wall and the plate 30. The chamber 33 is, by means of a nipple 35 and a tube conduit 36, connected to the outlet part 18 via a valve (not shown).

The container 28 also receives a bag 37 which is preferably made from an air impermeable material, such as plastic. An upper, open end of the bag 37 is clamped between the collar shaped part 25 and an upper edge of the container 28, as illustrated, and effectively seals the upper extent of the gap or slot 34.

The device operates in the following manner. When the vacuum cleaner has been started, dust-laden air is drawn through the inlet part 17 and tangentially into the cyclone housing 19 to create a vortex around the filter 24. Centrifugal forces cause heavier particles to be thrown outwardly toward the periphery of the cyclone housing, and gravitational forces cause the particles to fall downwardly toward a bottom of the bag 37. The partially-cleaned air at the center portion of the cyclone housing then passes through the filter 24 to the outlet part 18, thereby further cleaning the air before it passes through the fan to ambient.

In order to empty the cyclone separator, the cover 20 and the filter holder 23 are removed to release the upper edge of the filter 24 and thereby permit the filter 24 to fall downwardly

through the opening 27 in the liner 26 and into the bag 37. By removing the cyclone housing 19 from the container 28, the bag 37 can be lifted out of the container 28 and thrown away with its contents.

- 5        When a new bag is inserted in the container 28, the upper edge of the bag 37 is clamped between the collar part 25 and the upper part of the container 28 after which the vacuum cleaner is started. Normally the valve (not shown) is then in its open position. This means that an under-atmospheric pressure is  
10   created in the chamber 33 and the gap 34, and the pressure difference between the inside of the container 28 and the outlet part 18 causes air which is present between the bag 37 and the container wall to be drawn out through the tube connection 36 whereby the bag abuts the container side wall and the plate 30.  
15   If a bag is not used in the container 28, the valve is closed.

- In order to facilitate release of the disposable filter 24 and to ensure that the filter 24 falls down into the container 28 upon opening of the cover 20, the filter holder 23 can be integral with, or secured to, the cover 20. In such an  
20   arrangement, the outer periphery of the cover is preferably shaped as a cone while the outer portion of the filter in a corresponding way extends obliquely upwardly and outwardly away from the container.

## CLAIMS

1. A device for a vacuum cleaner which includes a cyclone separator connected to a vacuum source (11), said cyclone separator comprising a liner (26), a generally cylindrical cyclone housing (19), a collecting chamber (28), an inlet (17),  
5 an outlet (18), and a disposable filter (24), dust-laden air is drawn by said vacuum source through said inlet and generally tangentially into said cyclone housing, said liner (26) is disposed below the inlet and is generally shaped as a hollow up-side-down truncated cone defining a lower opening (27) facing  
10 toward the collecting container (28), said collecting container is located relatively below the opening, said outlet (21) is centrally arranged relative to the cyclone housing, said disposable filter (24) is disposed between said inlet (17) and said outlet (21), **characterized in** that the container (28) is  
15 adapted to receive an air-impermeable bag (37), means associated with said container are provided for securing the bag in the container by evacuating a space (33) between the bag and the container, and wherein said lower opening (27) is sized to permit the filter to fall therethrough and downwardly toward the  
20 container (28).
2. A device according to claim 1, **characterized in** that the filter is located at a side of a support means (23) which faces the container and which is arranged centrally at an upper end of the cyclone housing (19).
- 25 3. A device according to claim 1 or 2, **characterized in** that the cyclone separator includes a cover (20) comprising said outlet (21), said cover is removably secured to the cyclone housing (19), and an outer portion of the filter (24) is clamped between the cover (20) and the cyclone housing (19).
- 30 4. A device according to any of the preceding claims, **characterized in** that the cyclone housing (19) is removably secured to the container (28).
5. A device according to any of the preceding claims, **characterized in** that an area of the lower opening (27) is



greater than 20% and preferably greater than 30% of the cross-sectional area of the container (28).

6. A device according to any of the preceding claims, **characterized in** that the cyclone separator includes a cover (20) comprising said outlet (21), said cover is removably secured to the cyclone housing (19), and an outer portion of the filter (24) is clamped between the cover (20) and the cyclone housing (19).
7. A device according to claim 6, **characterized in** that said support means is secured to said cover.
8. A device according to claim 7, **characterized in** that removal of said cover from said cyclone housing permits said filter to fall downwardly toward said container.
9. A method for emptying a filter assembly for a vacuum cleaner, said filtering assembly comprising a cyclone housing having an upper end and a lower end, a cover releasably secured to said upper end of said cyclone housing, a collecting chamber having an upper end releasably secured to said cyclone housing lower end, and a disposable filter, said filter having a peripheral edge which is releasably secured to said cyclone housing upper end, **characterized in** the steps of:
- removing said cover from said cyclone housing;
  - releasing said filter peripheral edge to permit said filter to fall downwardly toward said collecting container;
  - removing said cyclone housing from said collecting container to gain access to an interior of said collecting container;
  - emptying said collecting container.
10. A method according to claim 13, **characterized in** that said assembly further comprises an air-impermeable bag, said bag being received within said container and being secured to said collecting container upper end, comprising the further steps of:
- releasing said bag from said collecting container upper end;
  - and,
  - removing said bag from said collecting container.

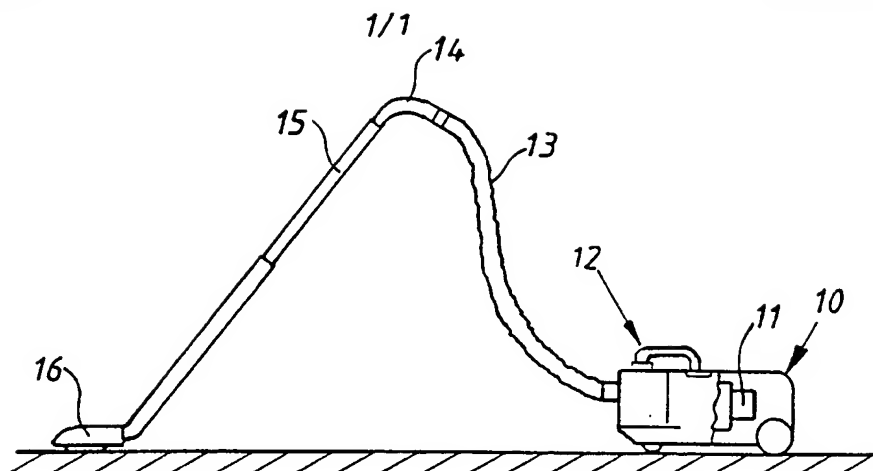


FIG. 1

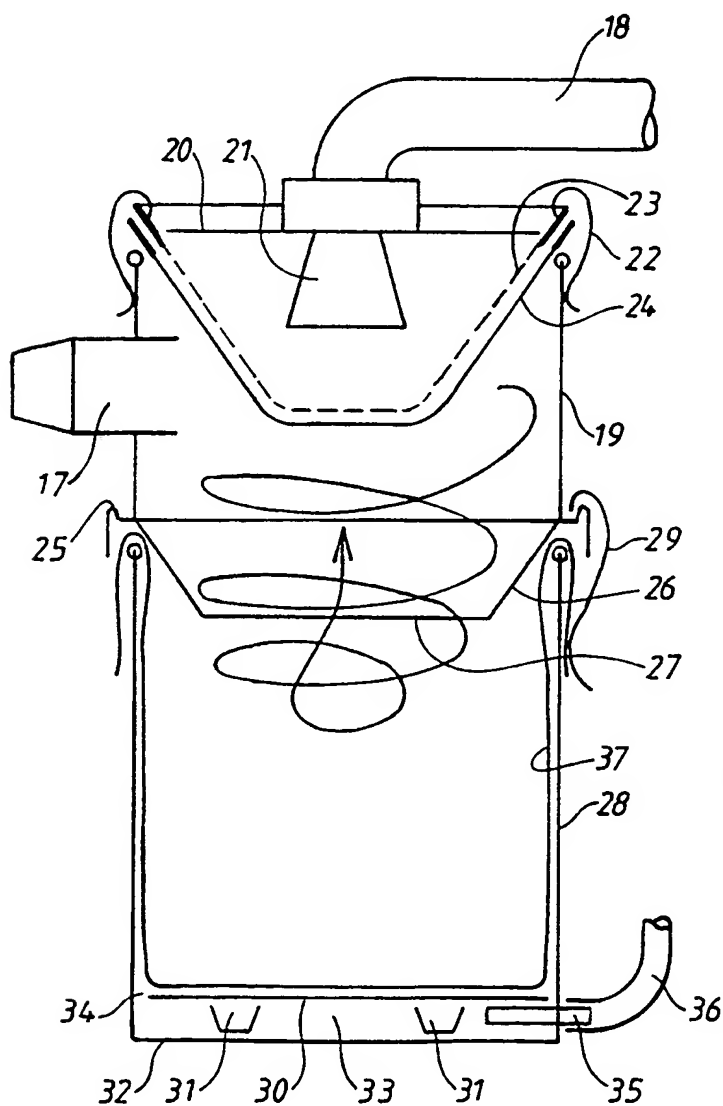


Fig. 2

1

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00241

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A47L 9/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A47L, B04C, B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0033250 A1 (NUMATIC ENGINEERING LIMITED), 5 August 1981 (05.08.81), figure 1 --	1,9
A	US 4811453 A (LUBRANIECKI), 14 March 1989 (14.03.89), figure 2 --	1
A	US 3755992 A (YLINEN), 4 Sept 1973 (04.09.73), figure 1 --	1
A	US 4523936 A (DISANZA, JR.), 18 June 1985 (18.06.85), figure 2 -- -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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24 April 1998

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29 -05- 1998

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/04/98

International application No.

PCT/SE 98/00241

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
EP	0033250	A1	05/08/81	NONE	
US	4811453	A	14/03/89	EP 0299815 A,B FR 2617037 A,B	18/01/89 30/12/88
US	3755992	A	04/09/73	NONE	
US	4523936	A	18/06/85	AU 580078 B AU 4485985 A CA 1252395 A DK 163027 B DK 593184 A GB 2162086 A,B US RE32788 E	22/12/88 30/01/86 11/04/89 13/01/92 26/01/86 29/01/86 22/11/88